Developing Teacher Educators and School Teachers through Collaborative School-based Action Research

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Introduction: The Challenge of Lesson Studies in Japan

In this paper, we consider a method for collaborative school-based action research by researchers and school teachers.

The Japanese lesson study has garnered attention in the United States and around the world as an effective methodology for building competence among teachers (Stigler and Hiebert, 1999). The following two points are among its characteristic features. First, it entails a type of in-school teacher training in which teachers prepare advance drafts of their lessons through discussion, conduct lessons in public, and then hold follow-up review meetings (Ishii, 2017). Second, researchers visit schools and collaborate with teachers to carry out lesson studies while using the schools as a base (Matoba, 2009). Having researchers participate in a lesson study allows for incorporating perspectives that would otherwise be difficult for teachers to notice on their own. This also promotes competency by making the lesson study more effective.

However, questions have been raised regarding researchers' involvement in school-based action research, the primary one being the problematic tendency for teachers to adopt a passive role when researchers comment on their lesson and share their research findings with the teacher (Cf. Sato, 2005). This problem has been characterised as an issue with the 'Research, Development, and Dissemination' model in that it deprives teachers of autonomy when researchers create a theoretical framework for a curriculum that they communicate to a teacher who then works devotedly to put the theory into practice (Sato, 1996).

The question then arises, how might we conduct a lesson study that would allow the researcher to support independent efforts on the teacher's part, rather than impose a model developed by the researcher alone?

This presentation considers this question by introducing a collaborative action research project (known as Project TK) conducted by the Curriculum and Instruction Seminar, Graduate School of Education, Kyoto University, and Takakura Elementary School, a public school in the city of Kyoto. This 15-year project, ongoing since its inception in 2003, involves graduate students working with school teachers to improve schools and school-based instruction. Graduate students want to become teacher educators or educational-practice researchers. The project's basic concept, the belief that 'children grow, teachers grow, and graduate students grow', positions it as a program fostering educational practice researchers in graduate school education.

Project TK is characterized by two major features. Firstly, the principal researchers involved in the lesson studies are graduate students rather than university lecturers. Secondly, it entails group interaction between teachers

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and graduate students, rather than on a one-to-one basis. From this Project TK initiative, we may be able to find a model for joint research that resolves the inherent problems of the teacher-researcher relationship in the context of lesson studies.

In this paper, we first provide a descriptive overview of Project TK and its history. Then, based on this year's efforts, we examine the process by which graduate students become involved in improving lesson practice. Finally, we examine how graduate students develop through this kind of joint research project, and we explore what manner of impact it has on teachers.

1. A Historical Outline of Project TK

First, we will provide a descriptive overview of Takakura Elementary School (TES) and the Curriculum and Instruction Seminar at Kyoto University (KU).

TES is a public elementary school located in Nakagyo Ward in the city of Kyoto. It has an enrolment of approximately 720 schoolchildren, with three or four classes in each year of instruction. There are 30 to 40 teachers, many of whom are young teachers hired within the past ten years. TES has convened the 'Smile 21 Plan Committee' involving the participation of teachers, parents, and local residents in a show of community solidarity that expresses the value placed on children's education.

The project involves graduate students enrolled in the Curriculum and Instruction Seminar held in the Graduate School of Education at Kyoto University. This field of research is also known as Educational Methods in Japan. The graduate students' research interests include curriculum and instruction as well as assessment, with a primary focus on school-based education. Their research topics vary widely. For example, one student studies physical education in the USA, another focuses on the International Baccalaureate (IB), and yet another researches new education in post-war Japan. Despite this diversity of interest, their studies share a common interest in school-based education and an emphasis on generating theory from collaborative field-based research.

After they complete their degrees, these graduate students intend to become university faculty specialising in curriculum and instruction. In Japan, faculty who study curriculum and instruction do not simply carry out lesson studies; in most cases, they are also responsible for teacher training at the university level. In other words, while these graduate students are in one sense educational-practice researchers, they must also acquire competence as teacher educators. Gaining on-site school fieldwork experience during their graduate studies is an important consideration for being hired to a university faculty position. However, unlike most universities specializing in teacher training, Kyoto University does not have any attached schools (at the elementary school, junior high school, or high school level). Therefore, this collaboration with TES offers graduate students an invaluable opportunity for conducting fieldwork.

Teaching staff at TES have collaborated with Kyoto University graduate students to pursue joint research with Project TK since 2003. Figure 1 summarizes the progress of the project for each year.

Figure 1: History of Collaboration between TES and KU Graduate Students

Year	Subject & Unit	Action Research Theme & Activity
2003 H.15	Japanese, Mathmatics, Science, and Social study	Creating relationships between teachers and graduate students Becoming 'scorers' who record and analyse lessons; becoming an 'information portal' presenting research findings about unit creation and teaching techniques in response to teachers' requests
2004 H.16	Japanese, Mathmatics, Science, and Social study	'Face-to-face' involvement by groups of teachers and groups of graduate students Participation in unit creation by subcommittee
2005 H.17	Japanese, Mathmatics, Science, and Social study	Continuation of involvement in a group system for each subject Formulation of procedures for project operation and rules for sharing information; formulation of an annual schedule; establishment of systems for deciding graduate student representatives, etc.
2006 H.18	Japanese, Mathmatics, Science, and Social study	Continuation of involvement in a group system for each subject Formulation of a graduate student development model, preparation of reports (finalising the name 'Project TK') (Commencement of a joint project involving Takakura Elementary School (TES), Goshosminami ES, and Oike JHS [The collaboration among these schools is called "OGT"]; convening a colloquium at Kyoto University; obtaining support from the graduate school)
2007 H.19	Mathmatics, Science, English, and Growing	In addition to an initiative to have graduate students participate in unit creation, participation begins in the mathematical literacy and scientific literacy sections 'Group Learning' is adopted as the theme of the joint study Participation in the 'Scholastic Ability Improvement Group', an in-school study organization
2008 H.20	Mathmatics, Science, and Social study	Adoption of 'Worksheets for Promoting Children's Learning' as a research theme Activities by several subject groups
2009 H.21	Mathmatics Grade 4 "the amount of change"	In response to a decreased number of graduate students, involvement in an arithmetic lesson study by all members 'Descriptive Instruction to Deepen Cognitive Ability' is adopted as a research theme Proposal of worksheets based on the challenge posed by significant differences in each group's respective understanding of the content Communicating the situation for groups and children to teachers with proper nouns; collaboration with teachers who emphasize class creation
2010 H.22	Mathmatics Grade 4 "area"	In addition to an initiative to have graduate students participate in unit creation, performance assessments are carried out jointly by teachers and graduate students
2011 H.23	Mathmatics Grade 2 "Reserch on shape of box" Grade 4 "line graph"	Development of arithmetic lesson incorporating performance assessments as a joint challenge for the mathematics department subcommittee as a whole Formulation of a preliminary rubric
2012 H.24	Mathmatics Grade 1 "subtraction (2)" Grade 5 "use average"	Designing performance tasks and assessment methods for lower-year students that draw on actual context Examining the potential relationship of rubrics to municipal standards for Kyoto
2013 H.25	Mathmatics Grade 5 "area"	Engagement of the theme 'How will unit-based instruction occur with the incorporation of performance assessments?' Reconsidering the relationship between performance assessments and paper test evaluation
2014 H.26	Mathmatics Grade 4 "area"	Participation in performance tasks and rubric creation
2015 H.27	Mathmatics Grade 2 "bulk" Grade 5 "area"	Engagements with rubric creation, unit creation, and the examination of lesson plans Along with discerning objectives at the core of units, focusing on how units are structured as a whole
2016 H.28	Mathmatics Grade 3 "numbers under 1 billion"	Engagements focused on performance assessment in the mathematics department
2017 H.29	Mathmatics Grade 5 "area"	Engagements focused on performance assessment in the mathematics department Proposal of performance tasks by graduate students; examination by the mathematics department subcommittee

(Adapted with reference)

When Project TK was in its early phases, graduate students participated in various subject departments, such as Japanese language, science, and social studies. While participating in each departmental group, graduate students played two major roles. The first was to carry out daily lesson observation and provide feedback to teachers. The second was to communicate their research findings to teachers upon request when participating in unit creation with the departmental group. Every year, the procedures by which the project is managed and the rules for providing information have been made clearer as the details have gradually been refined. In 2006, we summarized the efforts made over the past four years into a report.

Since 2009, graduate student enrolment has decreased, and as a result, the project now focuses only on the mathematics department group. Rather than joining each subject as individuals or in pairs, all graduate students observe lessons and study teaching materials for a single subject, and they learn through repeated discussion. Beginning in 2010 and in response to a request from TES, we launched an initiative that focuses on performance assessments. Rather than a paper-based test, performance assessment is a method of assessing children's scholarly ability through observing their efforts to solve problems requiring specific knowledge and skills (Nishioka, 2017). Currently, we are conducting a joint study of performance assessment, with a focus on the specific units involved in the mathematics department.

Although graduate students involved in Project TK initially participated in study groups for each subject, since 2009, the seminar's group efforts have coalesced around the study of performance assessment in the mathematics department. Project TK's daily lesson observations remain constant, as does graduate student participation in follow-up study and in-school teacher training. In addition to the observations and participation, the study and creation of teaching materials remain constant. In the next section, we will examine the specific kinds of joint research being carried out as a part of Project TK in line with this year's initiatives.

2. Project TK Initiatives for 2017

In coordination with the educational curriculum and schedule at TES, the following three activities have been carried out during the 2017 academic year. Namely, (1) 'unit-based lesson observation and feedback', (2) 'participation in follow-up study sessions and in-school teacher training', and (3) 'the study and creation of teaching materials oriented toward lesson observations'. The course of these activities is summarized in Figure 2. The mathematical units involved are 'quantities' for Year 2 students, 'decimals' for Year 4 students, and 'integers' and 'area' for Year 5 students. Below, we examine this year's initiatives in turn.

At the beginning of the year, two university faculty members, a graduate student representative, and the principal and the research director from TES met to discuss policies for the year. Collaborations to date had taken the form of teachers from TES thinking about performance assessment while graduate students participated in the associated lesson observation and follow-up study sessions. However, this year, it was decided that graduate students would propose performance assessment teaching materials for examination by TES teachers. These would then be implemented after mutual discussion, whereupon lesson observation and follow-up study sessions would be conducted. In other words, unlike past efforts, a policy was established whereby graduate students would have significant involvement in creating teaching materials relating to performance assessment.

Figure 2: Our Laboratory's Engagement with TES during the 2017 Academic Year from April to Octorber

Date (Month/ Day)	(1) 'unit-based lesson observation and feedback'	(2) 'participation in follow-up study sessions and in-school teacher training'	(3) 'the study and creation of teaching materials oriented toward lesson observations'
6/2			analysing Project TK until the previous year / the study of teaching material of 'quantity' unit
6/19	'quantities' for Year 2		
6/21	'quantities' for Year 2		
6/23	'quantities' for Year 2		
6/29	'quantities' for Year 2		
6/30	'quantities' for Year 2	follow-up study sessions and in-school teacher training for "quantities" unit	
7/14			the study of teaching material of 'decimals' unit for Year 4
7/18	'decimals' for Year 4	Lesson study of the mathematics department 'decimal'	
8/3			①analysing performance tasks of "area" unit until the previous year / the study of teaching material of 'area' unit
8/24			②collection of ideas for performance task of 'area' unit
9/13			③decision of performance task of 'area' unit
9/14	'integers' for Year 5		
9/15	'integers' for Year 5		
9/20	'integers' for Year 5		
9/21	'integers' for Year 5		
9/28			④discussion about advance drafts of 'area' unit
10/4			⑤discussion about advance drafts of 'area' unit
10/5		graduate students' proposal to teachers and discussion of performance task for 'area' unit	
10/23		Interview with a teacher of TES	
10/30	'area' for Year 5		
11/2	'area' for Year 5	'area' unit research class and on-site feedback session	
11/16	'area' for Year 5		
11/17	'area' for Year 5		
11/20	'area' for Year 5	Lesson study of the mathematics department "area"	

Under this policy, the current year's iteration of Project TK was launched. To start with, from the 19th of June 2017, graduate students observed lessons of the 'quantities' unit for Year 2 students, and then offered feedback. The principal activity in the 'quantities' unit was to learn the units for litres, decilitres, and millilitres (L, dL, mL) and to learn the methods for calculating volumes of water. Three or four graduate students participated in each lesson, and after the lesson observation engaged in a heated discussion of the value of the children's remarks and the intention

behind the teacher's questions. They then summarized their discussion and one observer wrote an 'impressions' essay and sent it to the instructor before the day's end. It was important that the graduate students could share their views with the teacher through these impressions. By providing opportunities for graduate students to convey their point of view, it was also expected that they would also start to build relationships with the teachers that were based upon trust.

These lesson observation and feedback efforts play a major role in the growth of the graduate students as researchers. Excerpts from the lesson impression essays can be found in Figure 3. Feedback from the impressions essay continued in the same way for the September unit on integers. There were two main objectives for the feedback. The first was for graduate students to develop their lesson observation techniques. Through observing a lesson and composing an impressions essay, graduate students could analyse the children's actual remarks and activities, as well as ascertain the meaning associated with teachers' questions, repeating these back to instructors in their own words. By keeping the reader (i.e. the teacher) in mind, graduate students were able to hone their skill of providing clear analysis and expression. For example, Figure 3 compares lesson impressions from June and September by a graduate student who joined the seminar in 2017. Compared with the impressions from June, those from September engage more concretely with the teacher's remarks and instructions, as well as the children's demeanour. Furthermore, after broadening his perspective with increased specificity, the student could offer a qualitative assessment of the impact of the teacher's remarks on the entire class, as though 'the atmosphere of the entire room suddenly brightened'.

On June 30th, a performance assessment on 'quantities' took place, after which students participated in a follow-up session. Similarly, students participated in a follow-up session for the 'decimals' unit on the 18th of July. During the study session following the lesson on 'decimals' for Year 4 students, teachers and graduate students broke up into small discussion groups of six to eight people. Focusing on the three perspectives of the *results*, *challenges*, and *impressions of the performance task*, a method was adopted in which group members wrote their impressions and opinions on sticky notes that they then exchanged. This allowed graduate students to gain a practical perspective from the teachers' point of view, as well as to learn a method for communicating their own analysis to the teachers in order to build a relationship of mutual understanding.

While building a relationship with teachers through (1) 'unit-based lesson observation and feedback' and (2) 'participation in follow-up study sessions and in-school teacher training', we proceeded in August to (3) 'the study and creation of teaching materials oriented toward lesson observations'. Studying the creation of teaching materials began with analysing the body of literature built up until the previous year and asking teachers about their own requests. This led to the decision to formulate this year's challenge as 'to create a performance task relating to "area" that would cover the entire unit'. In line with this policy, as well as deepening our understanding of teaching materials for teaching 'area' to Year 5 students, we subsequently carried out lesson observation with the same students for a unit on 'integers', attempting to apprehend the actual condition of the Year 5 children. Furthermore, we devised performance tasks and lesson plans based on our understanding of the teaching materials and the children in the class.

In the Year 4 unit on 'area', students learn how to calculate area for squares and rectangles. In the Year 5 unit on 'area', students consider formulas for calculating the area for shapes like triangles, trapezoids, and parallelograms, as well as the parallel translation of area. When thinking about a performance task, graduate students emphasized two perspectives. First, that it should be a task that necessarily requires students to think about using area in a real-

life scenario, and second, that they create a task that could be engaged with not only at the end of the unit, but also through the entire unit.

The specific performance task proposed by the graduate students is shown in Figure 4. In Kyoto, a city that is home to many foreign nationals, elementary schools are often visited by foreign residents. In the proposed task,

Figure 3: Lesson Impressions from a Master's Student

(The transcriptionist has placed a single underline below teachers' comments and demeanour, and a double underline below children's comments and demeanour)

① Lesson Impressions for 21 June (excerpt)
Although the objective this time was 'Let's think about ways to add and subtract quantities', I conjectured that this aim included the following two points. Namely, 'selecting the simplest method (i.e. the least time-intensive solution with the fewest figures) from a variety of methods of calculation' and 'calculating by aligning units'. When thinking about units of length and volume, I feel that the latter is positioned as the more important takeaway. That's because once you know the latter principle, you will be able to reckon the answers. Also, while watching the lesson, I felt that more than a few children got tripped up doing the sums and writing equations by dwelling on the units. That's why I suddenly thought that it might also have been a good idea to focus on the goal of learning the mathematical knowledge and skill of 'calculating by aligning units'. I thought that if the emphasis were placed on this goal, then it might also be a good idea to engage thoroughly in small steps, e.g. (1) underline the units (based on rules like drawing a straight line under L and a wavy line under dL); (2) look for identical units; and (3) add and subtract (while just leaving any figures for which no operations are necessary). However, in the final practice problem, children who at first had just been staring at the problems now seemed to be working through the solution by drawing red lines (straight and wavy). Also, after doing their initial calculation, some students became aware of their mistakes when they drew a red line, and through the second half of the lesson it also became apparent that some children had learned that it was important to align units when adding and subtracting volume.
② Lesson Impressions for 20 September (excerpt)
The primary focus of today's lesson seems to have been thinking about links with the sentence problem from last time and ingraining the method of operation by deepening students' understanding of common divisors from last time through thinking about ways of finding common divisors. When students were asked by the teacher to find a common divisor for 18 and 24, they were also instructed to write legibly in their notebooks how to find the common divisor. Thanks to this instruction, I saw some children who, rather than simply writing the answers, also wrote a combination of words and figures so that they would be able to explain it to someone else. On the other hand, although the teacher impressed on the students that there were a variety of ways of finding the divisor even for common multiples, I still saw some students who stopped thinking once they were satisfied that they had found a single method of derivation. That said, the children all presented their ideas, and several methods of derivation were written on the blackboard. In this entirely shared setting, the teacher tried to teach them how to think about divisors by asking the children for their opinion as to why 5 wouldn't work. What I found most impressive was how the teacher waited until a child had presented on 'a method that involves first making a list of the divisors of 24 and then writing X or O next to each according to whether it is also a divisor of 18' before stopping the lesson halfway through and asking the entire class questions modelled on the student's explanation. Then, when the teacher began asking everyone 'Does 2 [divide into 18]? How about 3? 4?…' students who until that point had simply been listening passively to the explanation gradually became enthusiastic and raised their hands. In that instant, during a lesson that had increasingly seemed to be going downhill, the atmosphere of the entire room suddenly brightened.

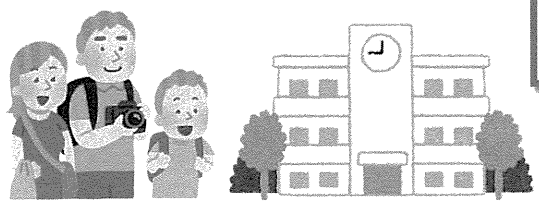
although students wanted to create a sign reading 'TAKAKURA' in English that could be read by foreign visitors, they had to calculate the number of sheets of paper that were required by finding the area. Two major points bear mentioning in the development of this unit performance task. First, the letter 'T' can be used to review how to find a rectangular area, and 'K' can be used to review how to find the area of a parallelogram, such that students can solve the performance task with techniques learned throughout the unit. The second point is that the task of finding the area for the rounded portions of the 'U' and 'R' entails finding approximate values by using the areas of triangles and trapezoids.

On the 5th of October, the graduate students presented the performance tasks they had created to teachers and a discussion was held. On this occasion, the teachers pointed out that while the gist of the performance task was

Figure 4: Performance Task and Rubric Proposed by Graduate Students

People from many different countries live in the Takakura area. To welcome those people when they come to visit Takakura Elementary School, we have decided to make a sign reading 'TAKAKURA' in English. However, we don't know how many sheets of coloured paper we will need to make the sign. Since buying a lot of coloured paper would be expensive, we decided to calculate how many pieces we would need by using origami paper. Please tell us how many sheets of origami we will need, and how much will be left over.

Aim: To calculate the number of sheets of origami paper required
Origami paper: 1 sheet is 100 cm^2 (10 cm × 10 cm)



Rubric		Contents	Expression / Explanation
	3	Finds ways to translate complex shapes into familiar shapes in order to more quickly calculate the area correctly. (Indicator) Calculates area by putting together trapezoids and parallelograms.	Finds ways to make explanations easy to understand. (Indicator) Lengths needed to calculate area are written on the figure. [Measures are taken to ensure values are not off by a large margin.]
	2	Translates complex shapes into familiar shapes in order to calculate area.	Provides information necessary for finding the area. (Indicator) Only equations are provided.
	1	[Support] Gives worksheets with previously-studied shapes to students who are unable to translate complex shapes into familiar shapes. By comparing these previously studied shapes with the complex shapes, students are made to recognise that the latter contain familiar shapes. Alternately, draws additional lines so that the area may be found more easily. To help students who have difficulty calculating the area of shapes, posts previously learned formulas for calculating area on the wall so that they become familiar with it; these may always be referred to. Gives sheet with lengths written on it to students who get stuck when trying to measure lengths.	

interesting, it would be necessary to lower the difficulty level in light of the students' actual level. The point of issue was whether the children should be made to tackle the rounded portions of the U and R or whether they should be given straight lines to work with. The graduate students expected the performance task to play a bridging role between the lesson content and the living world, and they emphasized thinking about how to find the area for curves when encountered in real life. While this expectation made the task interesting, it probably also made it more difficult. Having the graduate students and teachers bounce ideas off each other led to a solution: the teachers proposed that the U and R curves should be straightened so that it would be a task that the children could solve. Ultimately, we believe that this process yielded a more valuable learning task for the children. In this way, the graduate students and teachers went on to implement the task that they had refined through their discussions on October 30.

We must now ask how the TES teachers received these three initiatives. According to Mr Naitō, a study supervisor who has been continuously involved in Project TK, while having graduate students come to watch the lessons 'every time is a bit challenging, to be honest', he added that 'it would not be such a burden if they came for only a few hours each week'. He regarded the feedback from the lesson impressions as 'instructive for younger teachers'.

Regarding participation by graduate students during in-school teacher training, he stated, 'For example, when the graduate students took part in the follow-up study session, they would talk about their analyses, right? Since there were many perspectives that we did not really notice ourselves, I feel that that was very instructive'. Mr Naitō said that, for this reason, rather than talking as lecturers, it was very meaningful for the students 'to actually join the workshop'. He noted that the graduate students who had taken part in the school management council had a deep familiarity with the school. These students had used their experience to suggest a rubric for learning activities in integrated study units, and their contribution played a major role in extending the rubric to other subjects as well (For an actual rubric, see Fukushima 2017).

Regarding the graduate students' proposal for the task, he stated that this was a task that the teachers would not have come up with, and that 'the idea was interesting'. However, the way that the children were viewed was highlighted as a difference between the graduate students and the teachers. Mr Naitō keenly felt that 'while they are working at a really high level, unless they can call up the image of the children as they really are, they won't be able to run a truly great lesson'. Here, he demonstrated his understanding of the gap between expectation and reality that remained for graduate students who had not actually taught a lesson in the class.

Does this gap interfere in the dialogue between graduate students and teachers? We think not. Rather, we feel that teachers and graduate students with different backgrounds, knowledge, and views of the lessons should both face the same lesson practice if we are to improve the lessons. As a result, graduate students are conscious of teachers' viewpoints, and this contributes to building their competence as educational-practice researchers (See Figure 3).

3. Relationships among Children, Teachers, and Graduate Students

One of the aims of Project TK is for children, teachers, and graduate students all to experience growth at the same time.

As researchers in the Curriculum and Instruction Seminar, graduate students have learned the proprieties of research and acquired a certain degree of shared knowledge about curriculum, instruction and assessment. They are required to pursue their research specialties and to present at conferences or publish in academic journals on an ongoing basis. In particular, with curriculum and instruction, researchers are expected to be conscious of specialized research about educational theory as well the cyclical relationship with on-site practice in schools.

As educators, graduate students will offer university teacher training courses from as early as their enrolment in doctoral study, when they begin to provide direct instruction to university students. For example, some will teach a course titled 'Primary Education Curriculum Theory' as well as give lessons incorporating perspectives on the field of primary education that were not part of their own teaching accreditation or teaching experience. In these cases, graduate students should also oversee preliminary and follow-up guidance for academic education methodology and educational training exercises, both of which have a strong practical component.

As educational-practice researchers who study of aspects of education including lessons, teaching materials, and assessment in collaboration with elementary, junior high, and high school teachers, graduate students serve as lecturers and advisors for in-school teacher training sessions and public research groups. What is specifically called for, rather than the unilateral transmission of theory and practice at other schools, is advice based on the current conditions and practices at the host school. Also, we need graduate students who can demonstrate how the latest trends in educational forms, such as competency-based education and active learning, can be linked to the practices at the school in question, and who can understand the possible improvements this might conceivably bring about.

Figure 5 shows a model of graduate student growth based on this anticipated future image.

Here, we can point out that the model broadly involves three stages: (1) the 'watch and learn' stage in which students learn things like the project outline, how to engage with the school, how to watch lessons, and how to write up observation notes; (2) the 'watch and create' stage in which they create new lessons that draw on the results of their lesson observations; and (3) the 'coaching and disengagement' stage at which students step back from the project to provide guidance and generalize their knowledge for junior peers engaged in the 'watch and create' stage.

For example, in contrast to learning 'how to take lesson observation notes' in their third year of undergraduate study, when students visit schools to watch lessons (Stage 1), after proceeding to graduate study, students not only watch lessons but also become involved in lesson creation by taking part in review meetings and formulating performance tasks (Stage 2). In addition to this, at graduate school, students will gain experience by providing guidance to undergraduates and junior graduate students, as well as introducing the activities of Project TK to an external audience (Stage 3). In the doctoral course, students will sometimes engage the practices implemented at TES to write articles for scholarly publication that deal directly with activities at the school or explain ways of implementing performance assessments and follow-up review sessions. On these occasions, it becomes necessary to understand TES at a more general level. Through this kind of generalization, students acquire the opportunity to think about how they might be able to position these practices in the context of educational policy and reform.

In addition to these activities, through their participation in lesson studies, graduate students play different roles for children and teachers.

They perform daily lesson observations and provide teachers with feedback based on their analysis of their notes. The teaching staff at TES includes many young teachers, and each year of study contains about 36 students

Figure 5: Graduate Student Development Model

Stage			Year	Role	Relevant Knowledge	Developmental Task
Watch and Learn			B2	• Learn about pedagogy and teaching practice	• How to prepare a résumé	• Addressing and contextualizing one's own experience of education
			B3	• Observe a lesson at Takakura Elementary School (TES) in the Basic Seminar • Observe a research presentation session at TES	• School observation tour etiquette • How to take lesson observation notes • Curriculum content for the teacher development course	• Learning the minimum knowledge necessary for a school observation tour • Knowing the necessary skills for becoming a schoolteacher
			B4	• Write a graduate thesis • Participate in discussions in the teaching methodology lab	• How to write a thesis essay	• Framing the problem in academic terms to some degree
	Watch and Create		M1	From April: • Attend compulsory lectures • Summarise and present thesis at laboratory meetings • Begin direct involvement with TES Research presentations Advising younger peers	• Findings from teaching methodology lectures • Findings from essays related to TES • How to write out impressions • How to handle children's personal information • How to compare and read textbooks • How to read the government guidelines for education • How to carry out follow-up review meetings • Instruction on how to prepare a résumé • Instruction on how to take lesson observation notes	• Learning general knowledge about teaching methodology and lesson study • Becoming familiar with the project • Learning to formulate lessons based on observation • Trying to understand teachers' vocabulary • Knowing how a single lesson is situated in the context of the entire credit or course • Learning through giving instruction to undergraduate students
		Coaching and Disengagement	M2	• Writing a master's thesis	• Instruction on how to write out impressions • Formulation of performance challenges • Formulation of a rubric	• Framing one's own understanding of the problem in academic terms • Seeking out intersections between one's own research topic and the activities of Project TK
			D1	From April: After the research presentation meeting	• School-wide mechanisms • Laboratory-wide mechanisms	• Learning through instructing graduate students
			D2	From April: • Serve as a graduate student representative • Assist graduate student representatives After the research presentation meeting • Work together with next year's graduate student representatives	• Instruction on formulating performance challenges • Instruction on formulating rubrics • Generalisation of activities from TES and Project TK	• Generalisation of practice at TES through part-time and trainee instructors • Generalisation of activities at TES, (e.g. graduate students' introduction in a co-written volume or journal publication)
			D3	• Assist graduate student representatives	• Writing a thesis pertaining directly to Project TK	• A written thesis contextualizing initiatives at TES

(Adapted with Hatta, 2006)

(Japan's national standard for classroom enrolment is 40 students; Years 1 and 2 at TES are restricted to 35 students by Kyoto municipal policy). By adding several graduate students to this mix, we can obtain a more detailed grasp of the state of the children, and convey these observations to teachers through lesson observation notes and impression essays, as well as in review meetings.

The second role graduate students play is to provide research findings as required by teachers when participating in unit creation activities. Since 2010, we have focused on performance assessment, examining the scholastic ability that lesson units are intended to cultivate and conducting joint research into the performance tasks and assessment methods by which such ability can be measured. While performance tasks have been developed primarily for a mathematics unit on 'area', their content is updated annually based on the review of the previous year's efforts. Although teachers are regularly transferred at public schools like TES, the findings arising from this implementation (including such updates) are still accumulated with continuous involvement by graduate students, who remain engaged over a long span of at least five years (seven years for students who join the project as undergraduates). We are also able to bring this knowledge back to the school through the continuation of the seminar group.

Graduate students also grow through this kind of relationship between children and teachers. With Project TK, we have modelled graduate students' growth process (Figure 5) as a device to systematically promote their continued growth as educational-practice researchers and teacher educators.

Conclusion

This paper has explored how teachers and researches can conduct collaborative research. While some may doubt the extent of the contribution gained by introducing graduate students to school settings as novice researchers, we believe that the lesson study carried out by graduate students and teachers on a 'group-to-group' basis in Project TK has the following three advantages.

First, having graduate students involved in daily lesson observations makes it possible to achieve a lesson study model in which teachers are supported by researchers. While it is important for university faculty to communicate their findings from school-based research, it is difficult for teachers and researchers to collaborate on this basis alone. By contrast, with a collaboration model in which graduate students perform lesson observations and create teaching materials, rather than communicate research results and theoretical frameworks, it becomes possible to pursue joint research in line with the teachers' thoughts and ideas.

Second, by continuing to be involved on a group-to-group basis, the results of the joint study will continue to accumulate even after the graduate students complete their studies and individual teachers are transferred. We often see cases in which lesson studies fall into hiatus when a particular researcher stops participating or when teachers who had played a leadership role are transferred to a new school. However, by having graduate students and teachers engage on a group-to-group basis, we can aim at better practice by drawing on the accumulation of collaborative research findings by graduate students and teachers in a given year.

Third, this method cultivates an ethos of mutual growth between graduate students and teachers. The relationship between teacher and researcher tends to slip towards being a relationship in which researchers provide

one-sided 'teaching' to teachers who passively 'learn'. However, if graduate students trying to learn in the school setting are positioned as partners, teachers will be more likely to pursue collaborative research with an attitude of 'learning together'. By establishing such relationships, we can learn together and pursue mutually beneficial collaborative research even with schools and teachers as the main actors.

Finally, we would like to identify a future challenge. Project TK is based on the philosophy that 'children grow, teachers grow, and graduate students grow'. While this year's initiatives focused on creating teaching materials relating to 'area', in the future it will be important to pursue collaborative research that emphasizes lesson creation. This will necessarily entail activities that more accurately capture the actual state of children at TES.

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